

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Invention Design Proposal)

(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: SCPE291

Project Title: Gecko Cleaner

Project Type: Invention Design Proposal

To our best knowledge and after thorough literature research, as at 28 / 6 / 2022, there are / are no* similar works. If there are, the reference links are as below:

1. <https://prologic.hk/v910-%E6%99%BA%E8%83%BD%E6%8A%B9%E7%AA%97%E6%A9%9F%E6%A2%B0%E4%BA%BA/>
2. <https://news.stanford.edu/news/2010/august/gecko-082410.html>

The enhancement our project has made for the existing related products or research is summarized as below:

The window washing machine can walk on a curved surface using gecko capillary force and special design.

***Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.**

I. Background

Provide background information as to learn about the audience for whom the project is addressing
Provide highlights of the **literature review** and/or related technologies or devices, with the support of pertinent and reliable references

Provide an overview of work, create a point of view as to define the needs and insights of the audience, and mention the **research or technology gap the project is trying to fill**

Background information:

- The existing sweeping and wiping robots are expensive
- The existing sweeping and windowing robots have shortcomings

The problem to tackle:

- Clean the home easily and carefully
- Reduce dust and reduce allergens, which can help reduce the problem of nasal allergies
- Improve current window washing machine
- The shortage of manpower to wash the windows

Literature review highlights: The gecko's ability can be contributed by two types of forces - van der Waals forces and attractive forces. The former one was discovered by Robert Full while the latter was noticed by Andre Geim. The adhesion was due to van der Waals forces created between the spatulae and the surface. Andre Geim and fellow researchers at the University of Manchester succeeded in creating a synthetic material that mimics gecko feet called gecko tape. An adhesive material that exploits intermolecular forces could be crucial in certain environments where conventional adhesion tools such as suction and glues cannot function.

http://web.stanford.edu/group/mota/education/Physics%2087N%20Final%20Projects/Group%20Gamma/gecko.htm#_ednref2

Research gap and overview: Our machine can use gecko force and special design to walk and clean on curved surface. When we need to clean some curved windows, we can use it.

The current window washing machine can only walk on a flat surface, and we would like to fill in this gap.

II. Objective(s)

State the **aim(s)** of project

- Avoid safety problems caused by the need to clean high places
- Improve the shortcomings of existing sweeping and window wiping robots
- Can achieve the effect of cleaning high corners while other cleaning tools cannot do it
- Avoid safety issues arising from the need to clean relatively high places
- Make our life more convenient
- Reduce the company's operating costs by using machines

III. Methodology

List out and briefly describe the **approaches** that will be used to test the feasibility of the Invention e.g. use of equipment, materials, tests and related experiments

Explain the selected implementation strategies with the **scientific theory**

Equipment used:

- scissor
- desk
- window glass

Materials:

- Nano tape or tapes with similar functions as gecko capillary tape
- Mini four-wheel drive

Test: We attached tape on the wheels of the car, and let the car move on the horizontal surface, stick on the vertical surface and climb on the horizontal surface.

It is to ensure that the gecko force is able to let our design move on the window glass of buildings freely and safely as our product mainly relies on the gecko force to stick on the wall.

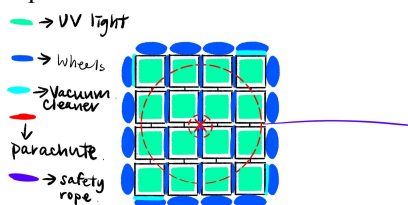
We use tape with similar functions as gecko tape to show that the feasibility of the function of gecko tape on the machine.

IV. Design of Invention

Describe the **design** and the **principle** of invention (e.g. The ideation of the projects or creative solution as far as applicable)

Provide sketches or drawings of the invention

Design: Our washing machine is divided into 16 parts in order to provide a larger surface area for the mecanum wheel, which uses gecko capillary force, to walk on curved surface area steadily. It can also provide flexible movement for the washing machine, for example, it can walk on different curved windows with different curvatures because it is separated into 16 parts.



V. Application / Market Need

Explain the area of **application** and **function** of invention

Indicate the market need and **potential impact** of invention

Discuss **limitation** and compare with existing related works (if any)

We can use it on the windows of commercial buildings, both indoors and outdoors and also in our house. For instance, the aquarium in Ocean Park and windows of Sky 100

For the market needs, some companies may require this invention for the cleaning of indoors and outdoors curved windows. It can make our lives more convenient and reduce the cost to recruit workers of workers of companies

There are limitations. We have to renew the gecko tape that is used because there may be dust attached to it, which may affect the function of the gecko tape. Moreover, the efficiency may be lower than large washing machines. The attrition rate of the windows can not be observed while the use of manpower can.

VI. Conclusion

Make a conclusion of the design project and the way forward of the invention process

The gecko cleaner can make our lives more convenient and can be adapted to clean different windows with different curvature. It is hoped that some programs can be further added to the machine so that it can clean the windows automatically. Besides, it is also hoped that the gecko wheel can be long-lasting and make the work more effective.

Our project is developed based on our school's previous project and the enhancement is as below: